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# IMPURITY DIFFUSION DEVICE FOR SEMICONDUCTORS

## CLAIM(S)

An impurity diffusion device for semiconductors, which is a device for applying the diffusion to said semiconductor wafers by loading and heating in a tube container the semiconductor wafer along with a crucible accommodating the diffusion source substance in particle or cake form that is to be diffused to the semiconductor, characterized in that a baffle layer for preventing the non-gasification flying of the diffusion source substance is installed on the diffusion source substance dissipation port.

An impurity diffusion device for semiconductors, as cited in Claim 1, wherein the baffle layer is a quartz layer in woolen sheet form.

## DETAILED DESCRIPTION OF THE INVENTION

The present invention pertains to an impurity diffusion device for semiconductors, particularly to a diffusion device wherein the sealed tube diffusion to the semiconductors is improved.

With the prior art sealed tube diffusion device for a silicon wafer, there is like the one shown in Fig. 1. In the figure, 1 indicates the sealed tube

container made of quartz tube, 2 a boat for the wafers for supporting the silicon wafers 3 and 3' in parallel inside said container, and 4 a crucible installed on both ends of said boat for accommodating the diffusion source substance 5. The diffusion source substance, for example, is Ga-Ge. When this sealed tube is loaded and heated in heating furnace 6, the diffusion source substance is dissipated and dispersed inside said sealed tube, reaches the surface of the silicon wafers 3 and 3', and is diffused.

By the prior art device, Ga-Ge is "scattered," (non-gasified flying) and forms spots on a silicon wafer surface, as shown in Fig. 2. This abnormal diffusion tends to locally generate Xj defects and ρs defects that penetrate through the $SiO_2$ layer even if the 1-2 μ thick $SiO_2$ layer is preliminarily formed on the wafer surface by thermal diffusion. As a measure to this problem, there is a method whereby the second and third wafers from the crucible are replaced with a dummy wafer. With this method, however, the Ga concentration becomes lower and a getter effect is reduced. In addition, the ρs becomes high and Na becomes low in the silicon wafer located apart from the source, so the defects in the wafers and the use of dummy wafers result in a loss of materials.

The present invention attempts to present an impurity diffusion device that can solve the aforementioned problems.

With the impurity diffusion device for semiconductors of the present invention a baffle layer, which can prevent the non-gasification flying of the diffusion source substance, is installed on the diffusion source substance dissipation port of the crucible for accommodating the diffusion source substance in the sealed tube diffusion device, and the baffle layer is made of quartz layer in woolen sheet form.

Subsequently, the impurity diffusion device for semiconductors into which the present invention is embodied as its one example is explained in detail below with reference to the figures. In Fig. 3 showing sectional views of said device, (a) indicates a vertical sectional view of the heating furnace, and (b) its a cross-sectional view. In the figures, 1 indicates the sealed tube container made of quartz tube, 12 the boat for wafers for supporting silicon wafers 2 and 3' in parallel inside said container, 14 the crucible installed on both ends of the boat for accommodating the diffusion substance 5. Inside said crucible, after the diffusion source substance is filled, there still is a remaining space between the substance and the top edge of the crucible. In this space, a baffle layer 7 is placed. For said diffusion source substance, for example, Ga-Ge particles were used. For the baffle layer, for example, a quarts layer shaped like a woolen sheet with nearly 8 μm or thicker was effective. The thickness of said quartz layer like a woolen sheet can be

selected properly taking into account the woven condition of the quartz layer (density and baffling effect). The Ga-Ge alloy in the crucible is attached once to the baffle layer and subsequently the Ga steam alone is dissipated in the sealed tube.

By the present invention, the diffusion wafer free from defects of Xj, ρs, and Ns caused by "scattering" can be manufactured. Since the "scattering" does not occur to the device of the present invention, the dummy wafer is not needed. Therefore, the wafers can be economized, and the number of processed wafers is increased (by the number equivalent to the number of dummy wafers), which is advantageous. In addition, the present invention comes with another advantage that it can be implemented without dramatically improving the device.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a sectional view of the prior art device. Fig. 2 shows an anterior view of the wafer manufactured by using the prior art diffusion device. Fig. 3 shows a sectional view of the diffusion device, which is one embodiment example of the present invention. In the figure 3, (a) and (b) indicate a vertical sectional view of the device and a cross sectional view of the device, respectively. In the figures, the same numbers indicate one same component or the equivalent component.

1. sealed tube container

3.3'. silicon wafers

5. diffusion source substance

6. heating furnace

7. baffle layer (quartz layer shaped like a woolen sheet form)

12. boat for wafers

13. crucible

Translations
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ABSTRACT:

PURPOSE: To prevent the non-evaporation dispersion of the diffusion source
matrial and thus to produce the diffusion wafer with no dispersion in its

performance by providing the baffle layer at the diffusion inlet of the diffusion source material in the crucible for the sealed tube diffusing device.

CONSTITUTION: Crucible 14 to contain diffusion material 5 of the Ga-Ge alloy
or the like is provided across wafer boat 12 to support siliconwafers 3, 3' and
so forth inside sealed tube conatiner 1, and baffle layer 7 consisting of the
quartz layer formed into the wool substance is located in the space between
material 5 and the upper edge of the crucible. When container 1 is heated up
in heating furnace 6, the Ga-Ge alloy in the crucible is sticked once to the
baffle layer, and then only the vapor is diffued into the sealed tube. Thus,
the diffusion wafer free from the performance dispersion of Xj, ρs, Ns and
other can be obtained with no non- evaporation dispersion sticked to the wafer.

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(全 3 頁)

# ㊹半導体用不純物拡散装置

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## 明　細　書

1. 発明の名称　半導体用不純物拡散装置
2. 特許請求の範囲
   1. 半導体ウエハをこの半導体に対する粒状ないし塊状の拡散源物質を容れたるつぼとともに封管容器に内装し加熱を施して前記半導体ウエハに拡散を施す装置にして、るつぼの拡散源物質蒸散口に拡散源物質の非気化飛出を防止するバッフル層を具備したことを特徴とする半導体用不純物拡散装置。
   2. バッフル層がウール状石英層であることを特徴とする特許請求の範囲第1項記載の半導体用不純物拡散装置。
3. 発明の詳細な説明

この発明は半導体用不純物拡散装置にかゝり、特に半導体ウエハに対する封管拡散の改良された拡散装置に関する。

従来シリコンウエハに対する封管拡散の装置で第1図に例示する如きものがある。図において、(1)は石英管でなる封管容器、(2)は前記容器内にてシリコンウエハ(3)(3')…を並列に支持するウエハ用ボート、(4)は前記ボートの両端に設けられた拡散源物質(5)を容れる「るつぼ」で、拡散源物質は一例として粒状のGa-Geである。かゝる封管を加熱炉(6)に装入し加熱を施すことにより、拡散源物質が前記封管中に蒸散分布してシリコンウエハ(3)(3')…の表面に至り拡散が施される。

上記従来の装置によればシリコンウエハの表面にGa-Geがいわゆる「とびちり」(非気化飛出)して第2図に示すポツ(3a)を見る。かゝる異常拡散は予めウエハ表面に一例の熱拡散による$SiO_2$層を層厚1～2$\mu$に設けても、この層を貫通して局部的な、$x_j$不良、$\rho_s$不良を発生しやすい。この対策としてるつぼに近いウエハから2枚ないし3枚をダミーウエハに置換して行なう手段もあるが、Gaの濃度が低くなり、ゲッタ効果も低減する。かつソースから離れたシリコンウエハの$\rho_s$は高く、$N_s$は低くなり、ウエハ内のバラツキとなる欠点、ダミーウエハを要することで材料の損失を生ずる欠点がある。



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この発明は上記従来の欠点を除去するための不純物拡散装置を提供するものである。

この発明にかゝる半導体用不純物拡散装置は封管拡散装置にて拡散源物質を容れるるつぼの拡散源物質蒸散口に拡散源物質の非気化脱出を防止するバッフル層を具備したものであり、さらにバッフル層がウール状石英層であることを特徴とする。

次にこの発明を一実施例の半導体用不純物拡散装置につき、図面を参照して詳細に説明する。

この発明にかゝる一実施例装置を断面図示する第8図は、図(a)に加熱炉の縦断面図、図(b)に横断面図によつて示される如く、(1)は石英管でなる封管容器、(2)は前記容器内にてシリコンウエハ(3)(3')…を並列に支持するウエハ用ボート、(4)は前記ボートの両端に設けられた拡散物質(5)を容れる「るつぼ」である。そして、前記るつぼは拡散源物質を容れたのち装すればるつぼの上縁までの間に空間を有し、こゝにバッフル(Baffle)層(7)が配置される。上記拡散源物質は一例の粒状のGa-Ge、またバッフル層は一例としてウール状に形成された石英層を約8㎜厚さ以上に形成して有効であつた。上記ウール状石英層の層厚は、石英層の「織り」の状態(充実度、バッフル効果等)を考慮して適宜決めてよい。上述の如くしてるつぼ中のGa-Geの合金は一旦バッフル層に附着したのち、Gaの蒸気だけが封管中に蒸散される。



この発明によれば、「とびちり」による $x_j$, $\rho_s$, Ns等のバラツキがない拡散ウエハを製造することができる。また「とびちり」がないためダミーウエハが不要であり、ウエハの節約、ウエハ処理数の向上(ダミーウエハ数相当のウエハ処理数向上)等顕著な利点を有する。さらにこの発明は特に装置に大改造を加えることなく実施が容易である利点も備える。

4. 図面の簡単な説明

第1図は従来の拡散装置の断面図、第2図は従来の拡散装置によるウエハの正面図、第8図はこの発明の一実施例の拡散装置の断面図にして、図(a)は縦、図(b)は横のいずれも断面図である。なお、図中同一符号は同一または相当部分をそれぞれ示



す。

1 ……封管容器
3, 3' ……シリコンウエハ
5 ……拡散源物質
6 ……加熱炉
7 ……バッフル層(ウール状石英層)
12 ……ウエハ用ボート
14 ……るつぼ

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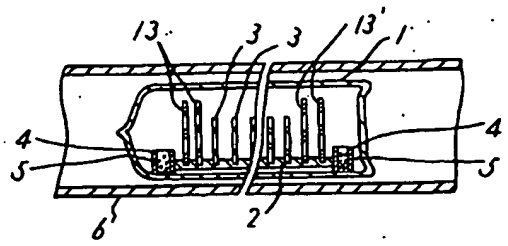
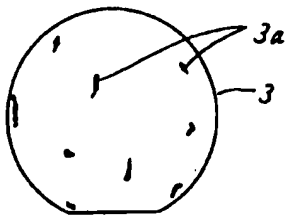
第 1 図

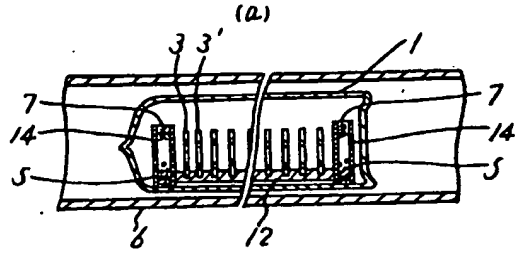



第 2 図



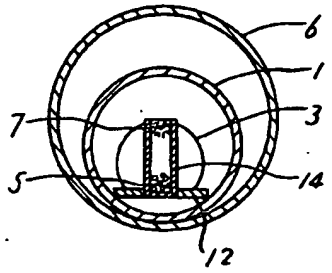

第 3 図

(a)




第 3 図

(b)



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